Pacific Gas and Electric Company

Janice S. Berman
Senior Director
Energy Efficiency Strategy

245 Market St., 663
San Francisco, CA 94105

(415) 973-1018
Janice.Berman@pge.com

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VIA E-MAIL
DINA.MACKIN@CPUC.CA.GOV

Dina Mackin
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Re: PG&E Comments on April 28, 2015 CPUC workshop on energy efficiency baseline choices (Rulemaking 13-11-005)

I. Introduction

PG&E appreciates the opportunity to submit comments related to the California Public Utility Commission's (CPUC) April 28, 2015 Workshop on Energy Efficiency Baselines (Baseline Workshop).

PG&E would like to provide some general feedback related to the impact of baselines on energy efficiency (EE) program design and implementation in California, and to convey concerns over the impact of the current policy which results in suboptimal pursuit of energy efficiency projects or measures in California by providing very limited incentive support to upgrade buildings or equipment which are well below modern building codes (Title 24) or appliance standards (Title 20). This policy inhibits the utilities' ability to fully contribute to California's EE and climate objectives because many customers, absent utility incentives and technical assistance, choose not to upgrade.

From a broad policy perspective, Governor Brown established aggressive targets for carbon emissions reductions and increases to the efficiency of the State's existing buildings.[1] These objectives point to a clear recognition that major untapped pockets of energy waste exist in California and that the primary objective of policy should be to create market conditions that encourage market actors to hunt out and upgrade inefficiencies. Achieving the State's ambitious environmental and EE goals will require robust activity in these areas and policies that target the

[1] See *Executive Order B-30-15* which establishes a target "to reduce greenhouse gas emissions to 40 percent below 1990 levels by 2030" and Governor Edmund G. Brown Jr.'s Inaugural Address of January 5, 2015 which aims to "double the efficiency of existing buildings" within 15 years.

State's least efficient buildings and equipment stock. The current incentive structure does not do this. In fact, the code baseline policy has the effect of making EE program incentives amounts larger, per unit of potential energy savings basis, for buildings that already perform at or near code level, as detailed below. Perversely, limited incentive support is provided to address inefficient buildings.

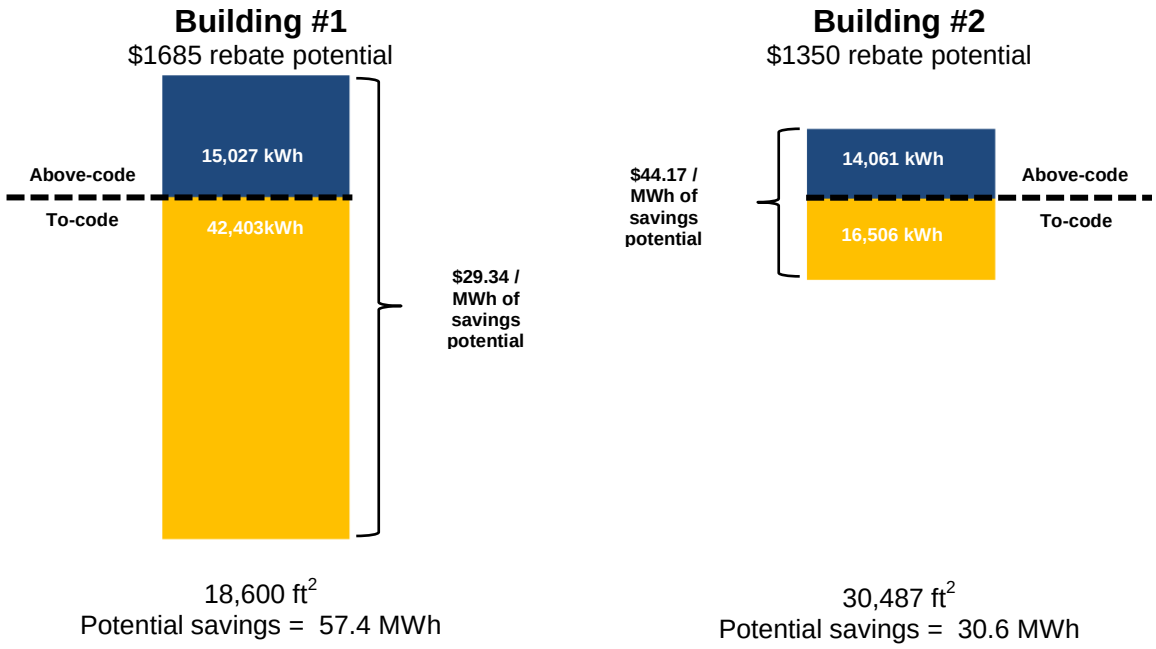
This effect is illustrated in Figure 1 below that shows two buildings selected from a set of 164 buildings remotely audited by building energy analytics firm FirstFuel Software, Inc. (FirstFuel).[2] These remote audits provide site-specific information related to the energy savings potential for a variety of retrofit measures. The figure shows energy savings potential identified in these two buildings at both the aggregate level and measure levels.

The savings potential above existing code (in blue) and to upgrade the building to-code (in yellow). Building #1 has substantially more energy savings potential – both on a square footage and an absolute basis – than Building #2, which has a 50% larger area. Under current program rules Building #2 is eligible for a 50% larger incentive on a per MWh basis when total available savings opportunity is considered. Current policy would not allow incentives to be offered to capture additional EE savings from operational measures (including Heating, Ventilation, and Air Conditioning (HVAC) operating and maintenance measures, scheduling controls, and air side economizer maintenance). It is certainly beneficial to California if IOU programs encourage Building #2 to upgrade, but the State is missing an opportunity if we fail to support the much less efficient Building #1 adequately to encourage it to upgrade. While data for these two buildings is not representative of California's entire commercial building stock, the results illustrate the challenges associated with targeting highly inefficient buildings under current EE program rules.

Furthermore, as noted in our response to Question #3 below, two preliminary studies conducted by FirstFuel and EnerNOC indicate that over half of the energy savings potential in existing buildings is in to-code savings, and that for one-third of commercial buildings examined, only to-code potential exists. The results of these analyses indicate that, given the large amount of to-code savings prevalent in California's existing building stock, the State could achieve more energy savings by addressing the significant potential that exists in bringing these less efficient buildings up to and beyond modern codes and standards.

[2] FirstFuel Software's remote audits have been shown to provide results comparable to on-site energy audits. Further information related to the technical validation of the FirstFuel remote audit platform is available at, http://info.firstfuel.com/technical-validation.

Figure 1 – A comparison of incentive levels and energy savings potential in two commercial buildings in PG&E's service territory



Measure	Savings (kWh)	Incentive
Lighting Retrofit	37,230	$1,125 ($1.5 / lamp)
Parking Lot Lighting Retrofit with Controls	20,200	$560 ($70 / fixture)

Measure	Savings (kWh)	Incentive
Lighting Retrofit	30,567	$1,350 ($1.5 / lamp)

Source: PG&E analysis based on building data from FirstFuel Software, Inc. and rebate levels from PG&E (2015), *Lighting Rebate Catalog*, http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/lighting_catalog_final.pdf.

At the workshop, ALJ Edmister encouraged parties to produce data in support of their positions. The invitation-only PG&E Commercial Whole Building Demonstration is underway and provides eligible customers (typically building owners and long-term lessees) with performance-based incentives to pursue comprehensive energy upgrades, based on reductions in energy consumption quantified using meter data analytics. PG&E designed the Demonstration to test the hypothesis that a whole building, pay-for-performance approach could reliably and affordably unlock significantly more energy savings in existing commercial buildings, especially small buildings, than the current widget-based approach. The approach in PG&E's Demonstration leverages customer engagement, leading-edge predictive analytics, and the wide variety of building data now available, including interval meter and weather data. PG&E will share demonstration results and lessons learned with CPUC staff as they become available, which is expected to be in mid-2016.

One issue raised in the workshop was the potential increase in EE program budgets caused by expanding the use of existing conditions baselines and providing incentives using meter-based reductions in energy consumption as the objective. In PG&E's view, using existing conditions baselines would not require an increase in EE program budgets, but would necessitate reprioritization of budget and redesign of incentive structures. For example, incentives that are lower than current levels, on a per kilowatt hour basis, could encourage movement in highly inefficient buildings without an overall budget increase. PG&E recommends that Commission Staff begin examining the issue by asking Navigant to varying incentive levels in their Potential Study in conjunction with the work Navigant is conducting on existing condition baselines.

A second issue raised at the workshop was the need to avoid double-counting energy savings. PG&E appreciates the importance of EE in procurement forecasting and concurs that EE savings should not be double-counted in the State's load forecast.

At the workshop, CPUC Staff presented the current methodology used to estimate incremental EE program savings. In their presentation, CPUC Staff clarified how, to avoid double-counting of energy savings, EE potential studies incorporate forecasts of naturally-occurring adoption, current Title 20 standards and Title 24 codes, and utility EE programs. This estimation method implicitly assumes that the State cannot accelerate the adoption of efficiency measures which are assumed to occur over succeeding decades.

At the workshop, California Energy Commission (CEC) Staff acknowledged that the cost effectiveness criteria used by the CEC to establish codes and standards (C&S) is not reflective of a customer's decision process. The CEC uses a net present value analysis at social discount rates over a 30-year period. Transaction costs, which are challenging to calculate, are typically not included in the CEC analysis. By contrast, customers typically focus on simple payback analyses and expect a payback within two years. As a result, codes and standards which are cost-effective from the CEC's perspective do not automatically result in customer implementation of projects.

In the process of avoiding double-counting, we observe that the CPUC's current baseline policy has an adverse impact on the overall amount of energy savings achieved in California. It is PG&E's view that, with application of incentives and technical assistance, we can encourage elimination of inefficiency and a faster migration to and beyond code. This situation is especially problematic for small and medium business (SMB) customers who lack easy access to capital and many competing resource demands. Competing business priorities require project economics with short payback periods to drive action. The amount of EE program incentives and technical assistance provided by utilities to is often the determining factor in whether a project occurs.

PG&E suggests that the CPUC, in collaboration with the CEC revise and align the existing systems of counting savings from EE program and C&S to encourage more energy savings. A discussion proposal for a modified accounting system is provided as the annex to this document.

Achieving California's ambitious goals for EE will require rethinking current policy to capture all of these potential energy savings. To accelerate the adoption curve and increase economic activity in the State, utilities should be allowed to incent incremental EE measures from existing conditions.

II. Responses to Questions

PG&E responds to each of the questions asked by CPUC staff below.

Question #1: The measure characterization list presented by CPUC staff— and included in the CPUC white paper presentation—identifies the measures that will be covered in the Baseline Analysis, and how they should be characterized. This is intended as a starting point for discussion analysis rather than a decision on baseline. Is the measure characterization list complete, or are there additional types of measures that may have uncaptured energy efficiency savings below code or ISP? Are they characterized accurately? What changes do you propose?

Implicit in the measure characterization list is a belief that the preferred way to estimate energy savings is to sum the estimated above-baseline savings from each measure replaced. Indeed, a measure-based approach is necessary for EE programs addressing upstream (manufacturing) or midstream (wholesale, retail, trade professionals) markets, as the end-use customer is unknown in these cases. However, with the widespread installation of interval meters in California and the development of new technologies to analyze energy consumption at individual sites, PG&E suggests that it is becoming increasingly feasible to measure energy savings using meter data to estimate reduced energy consumption post-treatment. PG&E posits that energy savings calculations based on customer-specific meter-data, which reflect the actual impact of projects on consumption, may be more accurate than estimate based on average consumption of new vs baseline measures.

PG&E is concerned that a measure-level approach energy savings calculation is incomplete and insufficient. Given our collective goal of achieving broader and deeper savings and eliminating the waste of energy, whether caused by equipment, operation, or behavior, programs are increasingly focused on capturing system-wide and/or whole building-level EE.

Meter-based savings calculation is already utilized for Home Energy Reports and Business Energy Reports, is used in a limited way for Energy Upgrade California home retrofit program, is being tested in PG&E Commercial Whole Building demonstration, and is being contemplated in the to-code pilots. Measure-based energy savings estimation should be used when appropriate, but the Commission should expand the use of meter-based estimates beyond the current program set to include more downstream programs where the end-use customer is identified.

Before proceeding to comments specifically related to the measure characterization list presented by the CPUC, PG&E would like to raise a few general questions and comments related to the whitepaper.

First, while PG&E is supportive of the CPUC's efforts to create dialogue around the baseline issue, we respectfully request that the CPUC provide additional information on the intended goals and future use of the whitepaper. For instance, is it the CPUC Staff's intent to perform a study of the existing conditions in the field for each of the proposed measure types using the Measure Category Classification for baseline and Effective Useful Life (EUL)?

Second, PG&E suggests that the CPUC focus not only on measure classification but also on the practical challenges with the current policy for some measure classes and on improving clarity about industry standard practice (ISP) and program concepts related to-code and baselines, especially that of early retirement (ER). PG&E notes that the issues raised in the following paragraphs regarding implementation of ISP and ER could be resolved, at least for a substantial portion of the portfolio, by shifting measurement of savings to a metered reduction in consumption approach. In the short term, PG&E recommends changes to the way ISP and ER are implemented to make them more tractable.

ISP baselines are used to estimate energy savings for custom projects when a code, standard, or other baseline is unavailable. ISP studies have been conducted by CPUC consultants and utilities. Interpretation of ISP studies and other information used in utility work papers and evaluations to establish baselines often has been contentious. Applying ISP results as a baseline to specific custom projects is difficult given the heterogeneous nature of specific businesses, competitive environments, management styles, and decision-making processes, among other factors. For instance, in the industrial, agricultural, and water (IAW) sectors, many custom projects can involve multiple measures which are difficult to classify and are unique to specific projects. The existing ISP guidance document[3] needs to be revised to establish protocols for methodology, scoring, and interpretation of results. For an ISP standard to be useful, clear definitions on these factors need to be established.

PG&E recommends that the CPUC review and clarify the definition of ER and the level of evidence required to establish this designation. The inherent subjectivity, cost, and time required to demonstrate ER preponderance of evidence are key factors dissuading customer acceleration of equipment retirement within custom programs and discourage wider ER adoption.

[3] See Industry Standard Practice Guide (2014), Version 1.2A, available at http://www.cpuc.ca.gov/NR/rdonlyres/9F18A591-1D11-43D5-977A-343F3A51D754/0/ISPGuideBookv12_A_livingfinal.docx.

The two key elements to establish an ER designation – proof of program influence on the customer's decision to accelerate equipment retirement and proof of existing equipment remaining useful life – are both very difficult to prove empirically. As a result, judgments of ER eligibility tend to be subjective and difficult for customers and program administrators to establish. Absent clear, consistent guidelines on what qualifies for ER or any reasonable assurance their arguments will pass muster, customers and project sponsors are reluctant to make the substantial time investment required to prepare their ER claim. Likewise, Program Administrators are reluctant to promote ER as a viable participation pathway given the difficulty in communicating the rules. Clear-cut, unmistakable eligibility guidelines are necessary for the ER framework to function as a true pathway to encouraging accelerated retirement of inefficient equipment within California customized EE programs. In the long run, the complexity introduced by the ER process could be eliminated by shifting measurement of energy savings to be based on metered reduction in consumption from existing conditions.

In the short run, PG&E's preferred solution is for sufficient Remaining Useful Life (RUL) to be assumed (using the default 1/3 EUL assumption) whenever existing equipment remains operational. Effectively, this would make ER the default measure classification whenever operational existing equipment is being replaced. The "preponderance of evidence" standard would be eliminated.

For deemed measure ER, PG&E supports the recommendation from Section 6.3 of Itron's *Nonresidential Downstream Lighting Impact Evaluation Report* (a.k.a. Work Order 29) to update workpapers with dual baselines in a manner that reflects the typical percentage of measure installations that would qualify for ER. As the study authors rightly note, the rigorous, project-specific "preponderance of evidence" ER requirements for custom projects are irreconcilable with the deemed program model, which relies on average savings values and minimal project-specific documentation to deliver low-cost, scalable programs to the mass market. Workpapers should be updated with dual baselines – the first baseline being reflective of "average" ER assumptions and the second baseline being code level – to more accurately reflect savings resulting from the program. PG&E supports the high-level framework for deemed ER recommended by Itron in this report, as well as the technical methodology used by Itron in Appendices G.4, G.7, and G.8 to calculate the blended dual baselines.

For deemed measure ER, PG&E would also support identifying baseline choices based upon customer size. Generally, smaller customers have a greater mix of low-efficiency products in their baseline (an example of this for lighting is provided in the response to Question #3), and as customers get larger the ER potential decreases. This approach would allow program administrators to target Small and Medium Business (SMB) customers to achieve deep savings.

In PG&E's response to Question #3, lighting data from the *California Commercial Saturation Survey*[4] is provided that demonstrates that "very small" businesses substantially lag behind the broader market in switching their lighting from 4-foot T-12s to a more efficient alternative.

Regarding the measure list proposal, PG&E recommends that the CPUC provide a clear definition of each "classification" in the table and map these classifications to industrial norms, as relevant. The "Measure Category Classifications" are similar to, but distinctly different from, the "Measure Classifications" already defined in the Statewide Customized Retrofit manual[5] program and those listed in the CPUC Staff document *Early Retirement Using Preponderance of Evidence*.[6]

Is the proposed new classification system intended to replace these systems defined elsewhere or to run in parallel? PG&E recommends using the measure classification systems already in place in Version 1.0 of the *Early Retirement Using Preponderance of Evidence* document to help avoid confusion that could be created by introducing a new system with new "Measure Category Classifications."

PG&E also finds that the distinction between the measure classification of "Equipment" and "Retrofit" unclear. Does "Equipment" equate to a new device requiring load while "Retrofit" refers to an existing piece of equipment? PG&E recommends that this distinction be clarified and each category be clearly defined.

Without clear definitions to refer to, the rationale for some of the current classifications is not clear:

- Control devices are generally considered a "Retrofit Add On" (HVAC controls, Vending Machine Controller) whereas lighting controls are considered "Retrofit," and Smart Strips are considered "Equipment."

- A lamp is considered "Equipment," but a ballast is a "Retrofit;" both of these items could be considered equipment (if not components), and both can be retrofit into an existing

[4] Itron, Inc. (2014), *California Commercial Saturation Survey*, available at http://www.energydataweb.com/cpucFiles/pdaDocs/1159/California%20Commercial%20Saturation%20Study_Report_Final.pdf.
[5] Utility Administrators (2015), *2013-15 Statewide Customized Retrofit Offering Procedures Manual for Business*, Version 7.0.
[6] CPUC(2014), *Early Retirement Using Preponderance of Evidence*, version 1.0, available at http://www.cpuc.ca.gov/NR/rdonlyres/8AB0DEB5-41B0-4881-BC63-F7EBBEC81318/0/ProjectBasis_EULRUL_Evidencev1July172014.pdf.

light fixture (which is a piece of equipment, though it's currently shown as "Retrofit" grouped with ballasts). This methodology is unclear and appears to be at odds with a water heater being considered "Equipment" while water fixtures are considered "Retrofit."

Specifically related to the measure classifications proposed, PG&E notes the following:

- The level of details for the industrial and agricultural sectors should mirror that of commercial and residential. For example, HVAC, building envelope, and process heating should all have similar subcomponents to those that are listed for the building sectors.

- Indoor and Outdoor lighting may be better served in different studies, as the fixtures, hours of use, EULs, and replacement schedules are markedly different from each other.

- Advanced system monitoring and logic technologies that enable end-use system fault detection and diagnostic alerts, analysis, and prioritization of "trouble tickets" for operations and maintenance (O&M) staff should be included in the list. While these measures/technologies may not add additional energy efficiency impacts, they do improve the in-service rate, the gross realization rate, and the EUL of any measure associated with the technology.

As the preceding paragraphs demonstrate, it is increasingly difficult to calculate energy savings by summing the savings from discrete measures. As technology becomes more complex, a number of measures, control systems, operational choices, and behavioral components may be used in combination to achieve greater energy savings than might be estimated from each measure in isolation. Lighting, HVAC, and building shell choices interact to impact total consumption. Where feasible, measuring the total energy savings realized based on meter data creates a motivation to design these complex projects in a holistic way to minimize overall consumption.

Question #2: In your professional experience, what are the types of actions in the market place that lead to buildings/energy end uses failing to meet code or be upgraded to ISP, and what measures do not get adopted because of this? Please be specific and comprehensive, listing out all types of activities and correlated measures that you are aware of. Please identify the types of building that these experiences apply to, ie, Class A, B or C commercial; public or private buildings, types of commercial activity, vintage of buildings etc. For instance, what ways do contractors act to avoid "triggering code"?

The CEC forecasts a migration of buildings and equipment to codes and standards over a long period of time. In other words, when a new code or standard is adopted, the majority of the market will not meet it; over time buildings and equipment slowly shift. While it is reasonable to assume that market migration will take time, it is also reasonable to assume that IOU programs

could intervene with the introduction of incentives and technical assistance to drive a faster migration. The current baseline and ISP application assumes that the migration curve is fixed and immovable, and therefore generally restricts IOU programs from endeavoring to move adoption at a more rapid pace.

In part, the assumption that market actors will bring buildings and equipment to current code levels within a reasonable timeframe is based on the view that these actors are entirely rational from an economic point of view. This is not, in reality, usually the case. There are numerous reasons and competing priorities that drive actors to undertake, or not undertake, EE upgrades. A short list of reasons actors may not pursue EE include: perception of a low return on investment (or of a more advantageous return on other investments), lack of easy access to capital, lack of technical knowledge, lack of time, and lack of interest. On the other hand, EE investments may be made for difficult-to-quantify reasons such as reputation or perceived comfort. This heterogeneity in customer situations and decision-making leads to a diversity of outcomes whereby some customers may have buildings and equipment that perform at levels that are consistent with the most recent codes and standards while other customers have buildings and equipment that have not been upgraded over several iterations of code. This is true for all types of equipment, including lighting.

The fact that buildings fail to perform at current code level is also a function of the natural cycle of equipment replacement. Equipment is not replaced and buildings are not retrofitted immediately when codes change. This leads to a host of situations within a set of customers where some customers may have some buildings and equipment that perform at levels that are nearly consistent with the most recent code and other buildings and equipment that have not been upgraded for some time and for several iterations of code. This is true for all types of equipment, including lighting.

Another factor that can lead to the deferral of EE projects and equipment that does not perform at current code level, relates to the economic attractiveness of EE upgrades in California versus other jurisdictions. This is an especially important consideration for large chains with a national footprint (*e.g.* big box and department stores, fast food chains, building supply companies) because their budget for EE will be directed towards projects with the best economic returns, inside or outside of California. Large national customers have indicated to PG&E's sales teams that the reduction of incentives paid in California as a result of 2013 Title 24 has caused them to pursue projects outside of California where incentive levels are higher. These deferred projects have a negative impact on achieving California's climate and EE goals and economic activity within the State.

Specifically in the commercial sector, two main sets factors can impact the decision to upgrade: (1) technology characteristics, and (2) customer features including size, building type, and geographical characteristics.

- **Technologies**

    - HVAC systems: HVAC systems are the most costly and complex systems in a building. For example, if a boiler is working, even if it is very old, it may make more financial sense to defer retrofits until it is beyond repair (see the example of the San Francisco multi-family boiler replacement program below). System complexity and operation downtime also impact decision making, as the performance characteristics of the existing system are known, while those of the new system aren't; any hiccup in the installation process can lead to lost sales and/or operational disruptions.

    - Motors: Motors are rewound instead of replaced, as the rewind cost is lower than replacement, especially for motors larger than 21 HP. It is estimated that 30% of California's motors are below-code, which presents a sizable opportunity.[7] Research by Navigant[8] indicates that for smaller motors, many agricultural customers do not adopt variable frequency drives (VFD) without additional incentives. Interviews conducted for the study concluded, "for putting VFDs on smaller (booster) pumps … without [a] rebate, they are still not perceived to be cost effective." The study also examined motor replacement and rewind practices (in section 5.1.2.1) and the results indicate that small refineries rewind the majority of their motors, with large refineries generally rewinding motors over 1,000 hp. Large refinery operators would prefer to replace even the large motors, but operational downtime for a large motor replacement (including the logistics of procuring a motor that is not commonly stocked) results in rewinding these motors in practice. In the case of both large and small refineries, the results indicate that early replacement of motors was not cost justified.

    - Customer-side transformers: Large commercial buildings often have customer-owned transformers that operate 24 hours per day and are frequently original to

[7] See MacCurdy, A. et al. (2013), *Dual Baselines for Industrial Retrofits that Trigger Energy Codes*, presented at the ACEEE 2013 Summer Study in Industry, available at http://energy-solution.com/wp-content/uploads/2015/01/Dual-Baselines-for-Industrial-Retrofits-that-Trigger-Energy-Codes_Energy-Solutions_ACEEE-2013.pdf.
[8] Navigant (2015), *Measure, Application, Segment, Industry (MASI): Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries*, available at http://www.calmac.org/publications/MASI_Motors_Opportunities_Final_Report.pdf.

the building. The code baseline eliminates nearly all beyond-code savings potential that could be claimed by replacing these transformers. PG&E estimates that 28,000 buildings have customer-owned transformers, representing approximately 200,000 transformers in PG&E's territory.[9]

- **Customer features (*e.g.* size, building type, and geographical characteristics)**

    - Customer size: The Commercial Saturation Survey suggests that very small customers substantially lag the broader market in converting to more efficient lighting. This is a segment that tends to be very resource constrained in which a handful of people are doing everything from running the business to serving customers to paying the utility bills.

    - Customer building type: Again using lighting as an example, the data can be sorted to investigate pockets of inefficiency by filtering by building type. While lighting is often considered an easier EE measure to implement, the lamp ballast, which needs to be changed out to improve the efficiency of linear fluorescent lighting, makes the project more complicated than simply switching out a bulb.

Program results also provide evidence that certain technologies can be classified as "repair indefinitely." Boilers are one example of this. From 2010 to 2012, a multi-family (MF) boiler replacement program was conducted in San Francisco. The program used American Recovery and Reinvestment Act (ARRA) funds to provide incentives that were larger and which covered more measures than current utility run MF boiler programs.[10] The SF boiler replacement program realized 243 projects for an estimated reduction of 238,270 therms. A report about the program indicates that "many of these properties have original boilers as old as the buildings themselves that date back to the early 1900s." While the program did not collect comprehensive data related to existing conditions of the project sites, case studies were produced and have been provided in a separate document to the CPUC. Of the 31 boiler replacement case studies in the document, the age of the replaced boiler was provided for four: two from 1920, one from 1935, and one from 1960. Six other case studies indicated that the boiler replaced was "original",

[9] A study conducted by Cadmus Group found that there were 353 active transformers in 43 sites surveyed, for an average of 7.5 transformers per building. There are 28,000 buildings in PG&E's territory that receive 480-volt service which equates to approximately 200,000 transformers. See Cadmus Group (1999), *Metered Load Factors for Low-Voltage, Dry-Type Transformers in Commercial, Industrial and Public Buildings*; and Consortium for Energy Efficiency (CEE) (2011), *Commercial and Industrial Distribution Transformers Initiative*, available at https://www.ceeforum.org/sites/default/files/library/7313/Distribution_Transformers_Initiative_2012_1.pdf.

[10] Additional information on the program design and results are available at Grecco, M. (2012), *Amnesty for Ancient Boilers*, ACEEE, available at http://aceee.org/files/proceedings/2012/data/papers/0193-000135.pdf.

meaning from the time of building construction. Using publicly available information,[11] the building ages were determined to be 1907, 1916, 1927, 1928, 1939, and 1941. The remaining 21 case studies did not provide an indication of the replaced boilers age nor did they specify that the equipment was "original." Although not a quantitative assessment, photos of these unspecified projects are provided in the document and provide a visual basis for estimating the age of the equipment. These program results demonstrate that customers often use boilers for decades and continue to repair them as needed rather than replacing them with more efficient models

In the residential context, pool pumps and motors are almost always the largest single electrical end-use of residential customers with pools. They typically use over four times the energy of a new refrigerator and they may account for 20% of the home's energy usage. A 1.5HP motor with a 1.6 service factor single-speed pool pump may consume up to 2,959 kWh and 2.17 kW annually.[12] Although replacing a single speed pool pump with a variable speed pool pump can save up to $1,000 annually on electric bills, replacing only the pool motor is a less costly and less labor intensive investment. In terms of the pool, there is no difference in performance. This is a less costly fix for a broken pool pump motor in terms of up front capital, but is much more costly over time. In 2009, Title 20 required all pool pumps or motors over 1 HP sold in CA to be two or above (*i.e.* variable speed). It did not however explicitly cover replacement motors, and this omission in the scope crated a limbo for two years until a correction appeared in 2010. However, confusion remains, and a majority of stakeholders still believe replacement motors are not subject to Title 20 code, and conversations with vendors suggest that installers are still swapping out bad motors with single-speed motors.

An additional consideration that leads buildings and their components remain below more current code is the complexity of the requirements related to 2013 Title 24. In anticipation of the 2013 code requirements, PG&E commissioned a study to look at the variety of code requirements associated with lighting and how they would be applied in a variety of building types and uses. The report examined a non-exhaustive set of 17 different use cases. In all cases, evaluating 2013 Title 24 compliance necessitated a detailed site-specific evaluation of multiple criteria and led to different requirements for each case. Given this complexity, customers may defer implementation of a project that would trigger the new code, preferring to repair and wait.

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[11] PG&E determined the age of the buildings from the website, http://ec2-50-17-237-182.compute-1.amazonaws.com/PIM/. The age of the buildings for which the program case studies provided dates were also checked and the dates provided in the case studies were confirmed.

[12] According to the two speed pump work papers PGECOPUM100 and KEMA, Inc. (2009), *California Residential Appliance Saturation Study (RASS)*, available at http://www.energy.ca.gov/appliances/rass/.

Question #3: What specific information/data can you provide on the volume of deferred retrofits and retrofits that avoided code triggers or code compliance? In what types of buildings (as clarified above)? What evidence is there that these cases reflect norms of market activity rather than the exception?

PG&E has commissioned two research projects to guide the design of the to-code pilots and provide data related to the amount of to-code potential that exists in PG&E's service territory. The results from these two research projects are currently undergoing the Commission's EM&V study review process, and therefore the results provided here should be considered preliminary. As a result, only the general methodology for each study and an indication of the preliminary results are provided here. PG&E looks forward to presenting the final data once it has completed the vetting process.

The two studies use different approaches to determine the amount of to-code and above-code energy savings potential in a set of commercial buildings within PG&E's service territory. One of the studies also provides an estimate of operational energy savings potential.[13]

The first study, conducted by FirstFuel, uses a detailed remote audit approach to examine 164[14] commercial buildings (offices, supermarkets, retail locations, and schools), almost all of which are in climate zones 12 & 13 (PG&E's territory in the Central Valley). Each of the buildings was remotely audited and the to-code, above-code and operational savings potential for 22 different energy savings measures was evaluated. The results indicate that, at the aggregate level, approximately two-thirds of energy savings potential is to-code while the remaining one-third is above-code. When operational savings are included, half of the potential energy savings are to-code, one-quarter are in operational improvements and only one-quarter are above-code. Furthermore, while there are buildings in the set for which most energy savings potential is above-code, this is not a majority of the buildings. Over one-third of the buildings analyzed have exclusively to-code and operational savings potential. Additionally, in over 90% of the buildings, a majority of the savings potential is to-code and operational.

[13] Operational savings are defined as savings achieved through the optimization of existing building equipment, including but not limited to HVAC equipment, lighting, refrigeration, and related control systems, via the identification and implementation of low/no cost measures, that reduce energy consumption and demand, and improve performance in buildings over time.

[14] This analysis includes 100 buildings that were randomly selected through a statistical sampling process (conducted by a third-party, Nexant) and uses remote audits of 64 buildings previously completed by FirstFuel for the PG&E Analytics Enabled Retrocommissioning program. Planned future work, expected to be completed by mid-2015, aims to expand the sample size by 100 – to a total of 256 buildings – by using remote audits being conducted for PG&E's Transmission & Distribution deferral pilot.

The second study, conducted by EnerNOC, uses a big-data analytics approach to examine approximately 66,850 commercial buildings across multiple sectors and all climate zones in PG&E's service territory. While it has a larger building set than the FirstFuel study, the research is limited to only the three dominant building energy end-uses, which are identifiable through: heating, cooling, and lighting. The study compares usage and building data (*e.g.* square footage and operating hours) to building models to evaluate actual consumption with that expected under 2013 Title 24 and to quantify the to-code and above-code savings potential for these end-uses resulting from installation of high-efficiency heating and cooling equipment and reduced wattage T8 lighting systems. The preliminary results show a similar ratio of to-code and above-code savings as the FirstFuel study, with 70% of the total potential electric savings being to-code, with the remaining 30% of the savings potential was above-code.

Upon completion of the CPUC and stakeholder review process, PG&E looks forward to providing more detailed results on these studies. We expect to include an analysis of the results by end-use and building-type. Further analysis of the research results can also provide insights into the types of buildings and end-uses that would be high-value targets of EE programs that make use of an existing conditions baseline.

Another approach for evaluating the volume of deferred retrofits uses saturation survey data (or possible supplements to the survey) to identify the customers, technologies, building types, building sizes, and geographies that lag the overall market. The *2014 California Commercial Saturation Survey Report*[15] provides a good example of this.

Table 1 illustrates lamp efficiency distribution by building type. The results show that warehouses, medical clinics, miscellaneous, and restaurants are still using many 4-foot T12 lamps. These are the least efficient lighting options examined and they do not perform at 2013 Title 24 levels.

[15] Itron, Inc. (2014), *California Commercial Saturation Survey*, available at http://www.energydataweb.com/cpucFiles/pdaDocs/1159/California%20Commercial%20Saturation%20Study_Report_Final.pdf.

Table 1 – Linear Lamp Efficiency Distribution by Business Type for PG&E – Indoor Lighting

Performance Group	Food/ Liquor	Health/ Medical - Clinic	Miscel-laneous	Office	Restau-rant	Retail	School	Ware-house
Base Efficiency	86%	83%	85%	94%	96%	72%	86%	41%
High Efficiency	14%	17%	15%	6%	4.4%	28%	14%	59%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Base Efficiency Tiers Distribution								
4-foot T12	3.0%	16%	20%	6%	36%	7%	7%	21%
4-foot Other	0%	0%	0%	0%	0%	0%	0%	0%
4-foot Unknown T8	2.9%	2.0%	3.8%	4.0%	2.6%	17%	3.2%	6%
4-foot Std 700 T8	47%	50%	38%	78%	49%	25%	61%	9%
4-foot Std 800 T8	33%	14%	23%	6%	8%	23%	14%	3.9%
High Efficiency Tiers Distribution								
4-foot High Performance T8	2.2%	17%	7%	2.7%	4.4%	9%	6%	38%
4-foot Reduced Wattage T8	11%	0%	6%	2.9%	0%	14%	7%	15%
4-foot T5	0.7%	0%	1.8%	0.9%	0%	5%	1.7%	6%
4-foot LED	0.1%	0%	0.2%	0%	0%	0%	<0.1%	0%
n	**49**	**50**	**94**	**101**	**61**	**76**	**77**	**35**

* **The results presented above have been weighted by site weight.** *n*'s represent the number of surveyed sites included in the analysis.

Source: Itron, Inc. (2014), *California Commercial Saturation Survey*, Table 5-16 p. 5-29, available at http://www.energydataweb.com/cpucFiles/pdaDocs/1159/California%20Commercial%20Saturation%20Study_Report_Final.pdf.

Table 2 shows that "very small" businesses are significantly lagging the overall market, with over 42% of their lighting coming from 4-foot T12s. Finally, in Table 3, within the "very small" segment, medical clinics, offices, restaurants, schools and warehouses all have a significant number of linear 4-foot T12 lamps; in the cases of very small schools and warehouses, more than 50% of lighting comes from 4-foot T12 lamps.

Table 2 – Linear Lamp Efficiency Distribution by Business Size for PG&E – Indoor Lighting

Performance Group	Large	Medium	Small	Very Small
4-foot T12	7%	0.7%	9%	42%
4-foot Other	0%	0%	0%	0%
4-foot Unknown T8	4.6%	3.0%	10%	1.5%
4-foot Std 700 T8	46%	71%	46%	34%
4-foot Std 800 T8	17%	13%	13%	9%
4-foot High Performance T8	2.6%	6%	14%	6%
4-foot Reduced Wattage T8	18%	4.8%	6%	4.1%
4-foot T5	4.5%	1.0%	1.7%	3.7%
4-foot LED	0.4%	<0.1%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**
n	**39**	**198**	**180**	**126**

* **The results presented above have been weighted by site weight.** *n*'s represent the number of surveyed sites included in the analysis. Large sites have annual usage over 1,750,000 kWh, Medium have greater than 300,000 kWh and less than or equal to 1,750,000, Small have max annual usage greater than 40,000 kWh and less than or equal to 300,000, and Very Small have annual usage less than or equal to 40,000 kWh.

Source: Itron, Inc. (2014), *California Commercial Saturation Survey*, Table 5-20 p. 5-34, available at http://www.energydataweb.com/cpucFiles/pdaDocs/1159/California%20Commercial%20Saturation%20Study_Report_Final.pdf.

Table 3 - Linear Lamp Efficiency Distribution by Business Type for Very Small-Sized Businesses – Indoor Lighting

Performance Group	Food/ Liquor	Health/ Medical - Clinic	Miscel-laneous	Office	Restau-rant	Retail	School	Ware-house
4-foot T12	0%	36%	16%	38%	26%	17%	68%	53%
4-foot Other	0%	0%	0.1%	<0.1%	0%	0%	0%	0%
4-foot Unknown T8	19%	1.9%	4.5%	2.8%	0.8%	3.5%	0%	0.2%
4-foot Std 700 T8	33%	19%	33%	27%	31%	20%	10%	18%
4-foot Std 800 T8	21%	18%	27%	10%	5%	24%	22%	5%
4-foot High Performance T8	27%	17%	11%	15%	33%	22%	0%	19%
4-foot Reduced Wattage T8	0%	8%	7%	7%	4.4%	5%	0%	4.2%
4-foot T5	0%	0%	2.1%	0.1%	0%	8%	0%	0.6%
4-foot LED	0%	0%	0%	0%	0%	0.1%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
n	**5**	**50**	**71**	**72**	**24**	**86**	**5**	**37**

* **The results presented above have been weighted by site weight.** *n*'s represent the number of surveyed sites included in the analysis. Very Small sites have annual usage less than or equal to 40,000 kWh.

Source: Itron, Inc. (2014), *California Commercial Saturation Survey*, Table 5-26 p. 5-38, available at http://www.energydataweb.com/cpucFiles/pdaDocs/1159/California%20Commercial%20Saturation%20Study_Report_Final.pdf.

Question #4: How do the Commission and CEC's assumptions about the rate of turnover compare with your observations of the market? Please be comprehensive and specific (like above). What evidence/ data can you provide?

In PG&E's experience, "repair indefinitely" equipment has the largest disconnect with the current existing framework for market turnover and EUL and with what is observed in the market. Motors, and the systems motors drive such as pumps, fans, compressed air, and HVAC equipment, as well as some technologies discussed in Question 2 (*e.g.* boilers and customer-side transformers) are all examples of "repair indefinitely" equipment that can last well beyond the EUL. Examining saturation data can lend insight into the rate of turnover for these types of measures.

The 2009 Residential Appliance Saturation Study (RASS) study included a question about the age of the main heating system (PG&E appendices, Table B4 Page 206). 11.5% of respondents in PG&E's service territory answered "over 30 years old", and only 3.3% answered less than a year old. More research of this type should be conducted, as we believe other anecdotal evidence on long-lived measures will also show up in the data.

Question #5: Equipment does burn out, and buildings do get retrofit, triggering code upgrades. Given this reality, coupled with the fact that federal and state Codes and Standards exist and set efficiency floors for replacement equipment and building renovations, how can the CPUC ensure that an existing conditions baseline will not provide customers incentives and credit utility programs for large amounts of savings that are already occurring anyway?

Using an existing conditions baseline in combination with estimating energy savings based on reduced metered energy consumption would have several potential consequences such as:

- some customers receiving incentives for projects they would have done anyway;
- some customers with highly inefficient buildings conducting projects they would not have done otherwise;
- some customers implementing operational and behavioral changes, control systems, lighting redesigns to reduce the number of fixtures, and other elements to reduce overall consumption;
- some funds currently dedicated to establishing, implementing, and evaluating ISP and ER being repurposed.

Energy Efficiency already makes adjustments to incentive levels and savings estimates to account for the fact that some projects receiving incentives would have happened anyway. This is a fact of life for EE program administrators. Changing the baseline to existing conditions does

present additional complexity in this regard, but it also presents additional opportunity to focus our attention on California's least efficient buildings, end-use segments, and technologies and to make a substantial difference in the State's total energy consumption.

III. Conclusion

PG&E thanks the CPUC for the opportunity to review and provide comments on the April 28, 2015 CPUC Workshop on Energy Efficiency Baselines. New tools and approaches are needed for EE in California to capture all of the potential savings in existing buildings. PG&E looks forward to continued collaboration with the CPUC and CEC on this subject to ensure that policy is positioned to achieve the State's ambitious climate and EE goals.

Sincerely,

Janice S. Berman

Attachment 1 - Case Studies - ARRA Boiler Program.pdf
Attachment 2 - PGE_T24Assessment_Appendix Use Cases_091113_V2.pdf

Annex – An accounting approach for to-code EE savings (for discussion)

Spurring innovation that achieves energy savings in the State's least efficient buildings will require a new approach to EE measurement. PG&E proposes that this approach be based on measurement of savings at the meter rather than on a "widget-basis" as most current programs are currently measured. A meter-based savings approach has several advantages. First, meter-based savings incentives encourage building owners and tenants to conduct deeper retrofits because owners will receive incentives for all energy savings activities being conducted (rather than for a specific set of measures or widgets). Second, meter-based savings simplifies EE projects by eliminating some of the administrative and implementation burden related to tracking which measures are eligible or not eligible for incentives. Finally, incentives based on measurement at the meter provide customers and contractors with an incentive not just for consuming less energy, but also for not consuming energy at all. For example, this would make lighting redesign to reduce the number of fixtures an attractive option in lighting retrofits, which would produce larger savings than a traditional lighting retrofit where the motivation might be to maximize incentives through replaced units. This would also be an avenue for increasing behavioral and retrocommissioning energy savings activity which is a challenging area within current programs.

The CPUC can unlock potential savings and set California firmly on the path of meeting its aggressive goals by working with the CEC to revise and align the existing systems of counting savings from EE program and C&S in such a way that encourages more savings and achieves high-potential EE projects.

To move the discussion forward, PG&E has developed a straw proposal that may help encourage experimentation beyond the current EE framework that can enable greater savings achievements. The proposal is just that, a proposal, and is intended to spur debate about how "real" savings can be assured with existing conditions baseline programs incorporated into our portfolios.

This proposed approach has two phases. In Phase 1, savings from programs that use existing conditions as the baseline programs would be incorporated without the benefit of evaluation studies. Once an existing program has operated for a period of time that is sufficient to allow evaluation studies, a second phase would leverage those evaluation, measurement and verification (EM&V) findings to establish how much of the savings generated by these programs is incremental, or what we refer to as incrementality. The approach is summarized in Table 4.

The proposal also includes a method to ensure there is no double counting of savings. During Phase 1, all savings that are from the existing condition to code baseline would be transferred from the C&S bucket to the programs bucket. This is the most conservative treatment possible to avoid double counting of savings. The treatment of the savings achieved by programs using existing conditions as the baseline would not change under the Efficiency Savings and Performance Incentive (ESPI) (*i.e.* no to-code savings achieved by these programs would count

toward ESPI savings-based earnings, but would continue to count toward C&S ESPI earnings). The C&S savings forecast would initially decrease to account for the amount of savings forecasted to be achieved by programs that use existing conditions as the baseline ("savings" row), but would then increase ("C&S forecast" row) as the incremental amount of activity driven by these programs would be captured in the macroeconomic data on building and construction activity. This means that the C&S forecast would implicitly be capturing the impacts of these programs. Lastly, the current portfolio-wide net to gross ratio would be used until better information on these programs becomes available.

In Phase 2, the results from evaluations would be incorporated to inform and update the assumptions in the initial approach. In this phase, savings accounting would not change from how it was treated in the initial phase – savings would still be claimed in programs and backed out of C&S. Any change to ESPI would be assessed at this time. The C&S forecast would not require adjustment from the initial period, as the forecast would already implicitly be picking up the incremental impact from the to-code programs, as explained in the Phase 1 description above. Lastly, net to gross would be updated to account for evaluation findings on free ridership.

Table 4 - Proposed accounting approach for to-code EE savings, for discussion

	Programs	C&S Program Savings	C&S Forecast
Phase 1: Initial approach			
Savings	+ program savings from existing conditions, as savings is transferred from C&S	- C&S savings, as savings transferred to programs	- C&S savings, as savings transferred to programs
ESPI	No change (to-code savings not counted)	No change, C&S ESPI-eligible does not change	N/A
C&S Forecast	N/A	N/A	+ C&S savings increases to account for increased building activity resulting from the impact of programs using existing conditions as the baseline
NTG	Current portfolio average	No change	
Phase 2: Revised approach (using data on incrementality)			
Savings	No change from initial approach for program accounting	No change from initial approach for program C&S accounting	No change from initial approach for C&S forecasting accounting
ESPI	To be assessed later	To be assessed later	N/A
C&S Forecast	N/A	N/A	No change, as incremental activity is already accounted for
NTG	Updated to account for evaluations of free ridership in the programs using existing conditions as the baseline	No change	